

## **Antiresorptive Treatment for Spaceflight Induced Bone Atrophy--Preliminary Results**

Adrian LeBlanc (USRA); Toshio Matsumoto (University of Tokushima Graduate School of Medicine); Jeff Jones (Baylor College of Medicine); Jay Shapiro (Kennedy Krieger Institute); Thomas Lang (University of California at San Francisco); Linda C. Shackelford (NASA-JSC); Scott M. Smith (NASA-JSC) ; Harlan J. Evans (Wyle Laboratories); Elisabeth R. Spector (Wyle Laboratories); Robert Ploutz-Snyder (USRA); Jean Sibonga (NASA-JSC); Toshitaka Nakamura (University of Occupational and Environmental Health); Kenjiro Kohri (Nagoya City University); Hiroshi Ohshima (Japan Aerospace Exploration Agency)

Detailed measurements from the Mir and ISS long duration missions have documented losses in bone mineral density (BMD) from critical skeletal sub-regions. The most important BMD losses are from the femoral hip, averaging about -1.6%/mo integral to -2.3%/mo trabecular. Importantly these studies have documented the wide range in individual BMD loss from -0.5 to -5%/mo. Associated elevated urinary Ca increases the risk of renal stone formation during flight, a serious impact to mission success. To date, countermeasures have not been satisfactory.

The purpose of this study is to determine if the combined effect of anti-resorptive drugs plus the standard in-flight exercise regimen will have a measurable effect on preventing space flight induced bone loss (mass and strength) and reducing renal stone risk. To date, 4 crewmembers have completed the flight portion of the protocol in which crewmembers take a 70-mg alendronate tablet once a week before and during flight, starting 17 days before launch. Compared to previous ISS crewmembers (n=14) not taking alendronate, DXA measurements of the spine, femur neck and total hip were significantly improved from  $-0.8 \pm 0.5\%/mo$  to  $1.0 \pm 1.1\%/mo$ ,  $-1.1 \pm 0.5\%/mo$  to  $-0.2 \pm 0.3\%/mo$ ,  $-1.1 \pm 0.5\%/mo$  to  $0.04 \pm 0.3\%/mo$  respectively. QCT-determined trabecular BMD of the femur neck, trochanter and total hip were significantly improved from  $-2.7 \pm 1.9\%/mo$  to  $-0.2 \pm 0.8\%/mo$ ,  $-2.2 \pm 0.9\%/mo$  to  $-0.3 \pm 1.9\%/mo$  and  $-2.3 \pm 1.0\%/mo$  to  $-0.2 \pm 1.8\%/mo$  respectively. Significance was calculated from a one-tailed t test. Resorption markers were unchanged, in contrast to measurements from previous ISS crewmembers that showed typical increases of 50-100% above baseline. Urinary Ca showed no increase compared to baseline levels, also distinct from the elevated levels of 50% or greater in previous crews.

While these results are encouraging, the current n (4) is small, and the large SDs indicate that, while the means are improved, there is still high variability in individual response. Three additional crewmembers have been recruited to participate in this experiment, with expected completion in late 2011.